PRELIMINARY SPECIFICATIONS SUBJECT TO CHANGE

High-Speed, Rail-to-Rail Input, CMOS Comparator

■ FEATURES (V^+ = 5V, Typical value, T_a = 25°C)

- Propagation Delay (T_{PLH} / T_{PHL})
  - NJU7725x 42ns / 35ns
  - NJU7726x 125ns / 32ns
- Rail-to-Rail Common-Mode Input Voltage Range 0.2V beyond Supply Rails
- Dynamic Transient Stabilizer ™
  - Rail-to-Rail Input with no propagation delay fluctuation
- Push-Pull Output (NJU7725x)
- Open-Drain Output (NJU7726x)
- Output Drive Current
  - Sink (V_O = 1V) 40mA
  - Source (V_O = 4V, NJU7725x) 37mA
- Supply Current 140µA/ch
- Supply Voltage 2.7V to 5.5V
- Operating Temperature -40°C to 125°C
- Lead-less Small Package
  DFN6-G1 (ESON6-G1) (1.6 x 1.6 mm)
  DFN8-U1 (ESON8-U1) (2.0 x 2.0 mm)
- Standard Small Package
  SOT-23-5, SC-88A
  MSOP8 (VSP8)

■ APPLICATIONS

- Protection circuit for overvoltage detection, overcurrent detection, overheat detection, etc.
- Window comparators
- LED drivers
- Relay drivers
- Electronic and electrical equipment in general
- Voltage Level Translators

■ DESCRIPTION

The NJU7725x, NJU7726x series are Rail-to-Rail Input CMOS comparators featuring High-Speed. These comparators operate from 2.7V to 5.5V and low supply current of 140µA/ch. typ. This feature is suitable for battery powered application.

NJU7725x, NJU7726x series features the newly developed circuit technology Dynamic Transient Stabilizer ™ realizes full swing input with suppressed fluctuation of propagation delay time. In addition, the common mode input voltage range that exceeds the power supply voltage range is specified, and voltage detection near the power supply voltage is supported.

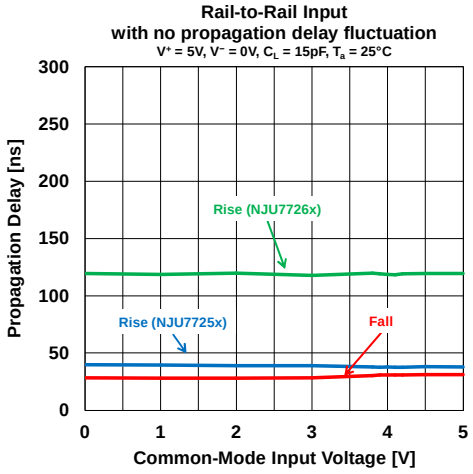
NJU7725x, NJU7726x series are available in ultra-small, leadless package measuring 1.6 mm x 1.6 mm (DFN6) and 2.0 mm x 2.0 mm (DFN8), and industrial standard leaded packages SOT-23-5, SC-88A, and MSOP8 (VSP8).

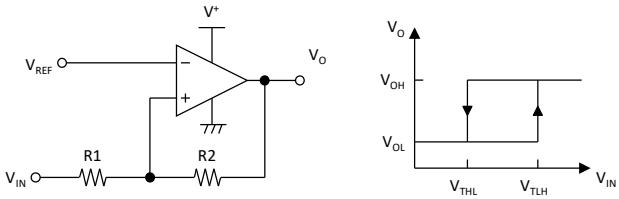
Dynamic Transient Stabilizer ™ ; It is a circuit technology that suppresses fluctuations in propagation delay time even if the reference voltage for voltage detection fluctuates.

NJU772xx Series Comparator Lineup

Product Name	Output	Supply Current	Propagation Delay
NJU7721x	Push-Pull	0.6µA/ch	9.8µs
NJU7722x	Open-Drain	0.6µA/ch	9.8µs
NJU7723x	Push-Pull	6.0µA/ch	780ns
NJU7724x	Open-Drain	6.0µA/ch	840ns
NJU7725x	Push-Pull	140µA/ch	42ns
NJU7726x	Open-Drain	140µA/ch	125ns

■ TYPICAL CHARACTERISTICS AND APPLICATION





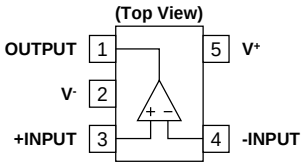
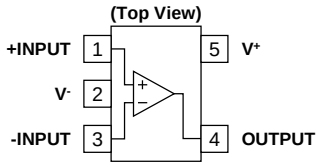
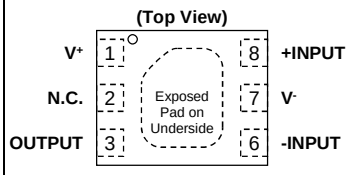
$$V_{TLH} = \frac{R1+R2}{R2} V_{REF} - \frac{R1}{R2} V_{OL}$$

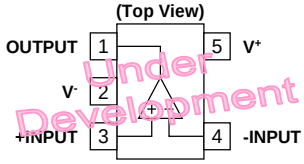
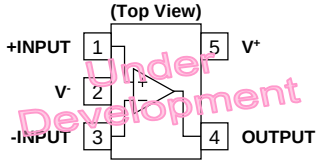
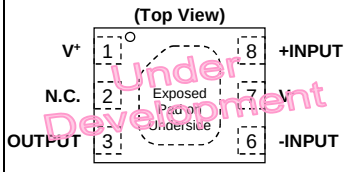
$$V_{THL} = \frac{R1+R2}{R2} V_{REF} - \frac{R1}{R2} V_{OH}$$

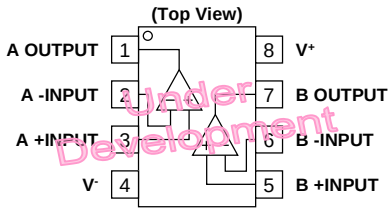
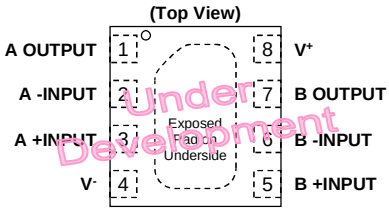
Noninverting Comparator with Hysteresis

PRELIMINARY SPECIFICATIONS SUBJECT TO CHANGE

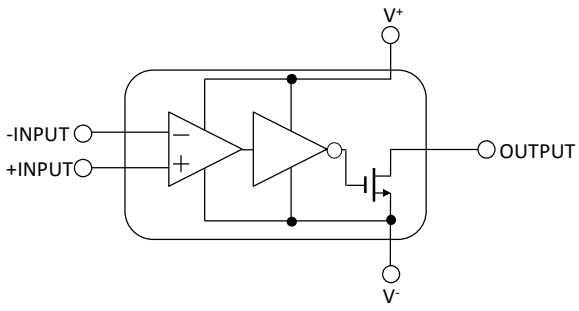
■ PIN CONFIGURATIONS

PRODUCT NAME	NJU77250F	NJU77250F3	NJU77251F	NJU77251F3	NJU77251KG1
PACKAGE	SOT-23-5	SC-88A	SOT-23-5	SC-88A	ESON6-G1
Pin Functions					 *Connect to exposed pad to V⁻

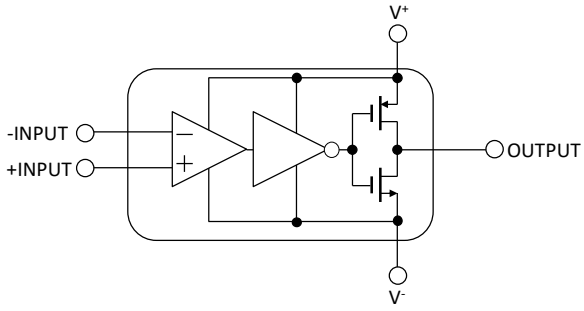
PRODUCT NAME	NJU77260F	NJU77260F3	NJU77261F	NJU77261F3	NJU77261KG1
PACKAGE	SOT-23-5	SC-88A	SOT-23-5	SC-88A	ESON6-G1
Pin Functions					 *Connect to exposed pad to V⁻

PRODUCT NAME	NJU77252R NJU77262R	NJU77252KU1 NJU77262KU1
Package	VSP8	ESON8-U1
Pin Functions		 *Connect to exposed pad to V⁻

■ BLOCK DIAGRAM

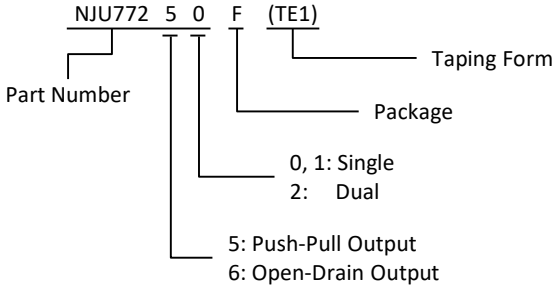


Open-Drain Output



Push-Pull Output

■ PRODUCT NAME INFORMATION



■ ORDERING INFORMATION

PRODUCT NAME	PACKAGE	RoHS	HALOGEN-FREE	TERMINAL FINISH	MARKING	WEIGHT (mg)	MOQ (pcs)
NJU77250F (TE1)	SOT-23-5	Yes	Yes	Sn2Bi	1S	15	3000
NJU77250F3 (TE1)	SC-88A	Yes	Yes	Sn2Bi	F5	7.5	3000
NJU77251F (TE1)	SOT-23-5	Yes	Yes	Sn2Bi	1U	15	3000
NJU77251F3 (TE1)	SC-88A	Yes	Yes	Sn2Bi	F6	7.5	3000
NJU77251KG1 (TE3)	DFN6-G1 (ESON6-G1)	Yes	Yes	Sn2Bi	77251	3.5	3000
NJU77260F (TE1)	SOT-23-5	Yes	Yes	Sn2Bi	-	15	3000
NJU77260F3 (TE1)	SC-88A	Yes	Yes	Sn2Bi	-	7.5	3000
NJU77261F (TE1)	SOT-23-5	Yes	Yes	Sn2Bi	-	15	3000
NJU77261F3 (TE1)	SC-88A	Yes	Yes	Sn2Bi	-	7.5	3000
NJU77261KG1 (TE3)	DFN6-G1 (ESON6-G1)	Yes	Yes	Sn2Bi	77261	3.5	3000
NJU77252R (TE1)	MSOP8 (VSP8)	Yes	Yes	Sn2Bi	77252	21	2000
NJU77252KU1 (TE3)	DFN8-U1 (ESON8-U1)	Yes	Yes	Sn2Bi	77252	5.3	3000
NJU77262R (TE1)	MSOP8 (VSP8)	Yes	Yes	Sn2Bi	77262	21	2000
NJU77262KU1 (TE3)	DFN8-U1 (ESON8-U1)	Yes	Yes	Sn2Bi	77262	5.3	3000

■ ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	$V^+ - V^-$	7	V
Input Voltage (1)	V_{IN}	V^- − 0.3 to V^+ + 0.3	V
Input Current (1)	I_{IN}	10	mA
Differential Input Voltage (2)	V_{ID}	±7	V
Output Terminal Input Voltage (3)	V_O	V^- − 0.3 to V^+ + 0.3	V
Power Dissipation (T_a = 25°C) SOT-23-5 SC-88A DFN6-G1 (ESON6-G1) MSOP8 (VSP8) DFN8-U1 (ESON8-U1)	P_D	2-Layer / 4-Layer (4) 480 / 650 360 / 490 330 / 1200 (5) 500 / 660 450 / 1200 (5)	mW
Storage Temperature	T_{stg}	-65 to 150	°C
Junction Temperature	T_j	150	°C

(1) Input voltages outside the supply voltage will be clamped by ESD protection diodes. If the input voltage exceeds the supply voltage, the current must be limited 10 mA or less by using a restriction resistance.
(2) Differential voltage is the voltage difference between +INPUT and −INPUT. The absolute maximum input voltage is limited at 7V.
(3) The output terminal input voltage is limited at 7V.
(4) 2-Layer: Mounted on glass epoxy board (76.2 mm × 114.3 mm × 1.6 mm: based on EIA/JEDEC standard, 2-layer FR-4).
4-Layer: Mounted on glass epoxy board (76.2 mm × 114.3 mm × 1.6 mm: based on EIA/JEDEC standard, 4-layer FR-4), internal Cu area: 74.2 mm × 74.2 mm.
(5) 2-Layer: Mounted on glass epoxy board (101.5 mm × 114.5 mm × 1.6 mm: based on EIA/JEDEC standard, 2-layer FR-4) with exposed pad.
4-Layer: Mounted on glass epoxy board (101.5 mm × 114.5 mm × 1.6 mm: based on EIA/JEDEC standard, 4-layer FR-4) with exposed pad.
(For 4-layer: Applying 99.5 mm × 99.5 mm inner Cu area and a thermal via hole to a board based on JEDEC standard JESD51-5.)

■ RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	CONDITIONS	VALUE	UNIT
Supply Voltage	$V^+ - V^-$		2.7 to 5.5	V
Input Voltage (8)	V_{IN}		V^- − 0.2 to V^+ + 0.2 (MAX 5.5)	V
Output Terminal Input Voltage	V_O	NJU7726x	V^- − 0.2 to V^- + 5.5	V
Operating Temperature	T_{opr}		-40 to 125	°C

■ **ELECTRICAL CHARACTERISTICS** (V^+ = 5V, V^- = 0V, R_L = Open, T_a = 25°C, unless otherwise noted.)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
INPUT CHARACTERISTICS						
Input Offset Voltage	V_{IO}	V_{COM} = -0.2V	-	1	7	mV
		V_{COM} = 5.2V	-	1	9	mV
Input Bias Current	I_B		-	1	-	pA
Input Offset Current	I_{IO}		-	1	-	pA
Common-Mode Input Voltage Range	V_{ICM}	CMR ≥ 55dB	-0.2	-	5.2	V
Common-Mode Rejection Ratio	CMR	V_{ICM} = -0.2V to 5.2V	55	70	-	dB
OUTPUT CHARACTERISTICS						
High-level Output Voltage (NJU7725x)	V_{OH}	I_{SOURCE} = 4mA	4.8	4.9	-	V
Low-level Output Voltage	V_{OL}	I_{SINK} = 4mA	-	0.1	0.2	V
Output Leakage Current (NJU7726x)	I_{LEAK}	V_O = 5V	-	1	700	nA
Output Short-Circuit Current (NJU7725x)	I_{SC}	I_{SOURCE}, V_O = 0V		85	-	mA
Output Short-Circuit Current	I_{SC}	I_{SINK}, V_O = 5V		65	-	mA
POWER SUPPLY						
Supply Current per Amplifier	I_{SUPPLY}	V_{COM} = -0.2V	-	140	210	µA
		V_{COM} = 5.2V	-	200	300	µA
Supply Voltage Rejection Ratio	SVR	V^+ = 2.7V to 5.5V	60	85	-	dB
Transient Response (R_L = 5.1kΩ, C_L = 15pF, Overdrive = 100mV) (NJU7725x)						
Propagation Delay (Low to High)	t_{PLH}		-	42	-	µs
Propagation Delay (High to Low)	t_{PHL}		-	35	-	µs
Rise Time	t_{TLH}		-	4.0	-	ns
Fall Time	t_{THL}		-	3.5	-	ns
(NJU7726x)						
Propagation Delay (Low to High)	t_{PLH}		-	125	-	µs
Propagation Delay (High to Low)	t_{PHL}		-	32	-	µs
Rise Time	t_{TLH}		-	250	-	ns
Fall Time	t_{THL}		-	2	-	ns

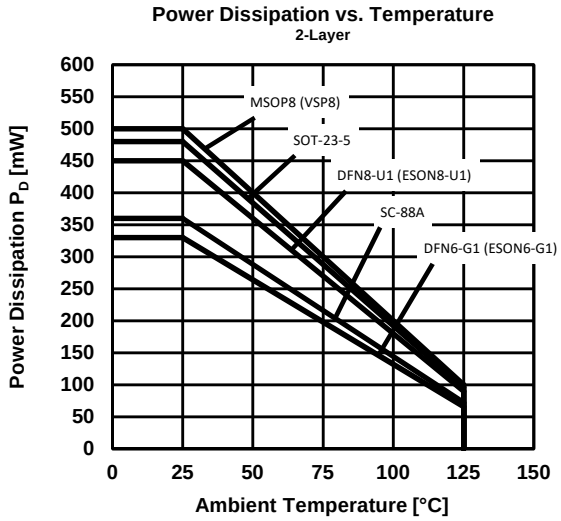
■ THERMAL CHARACTERISTICS

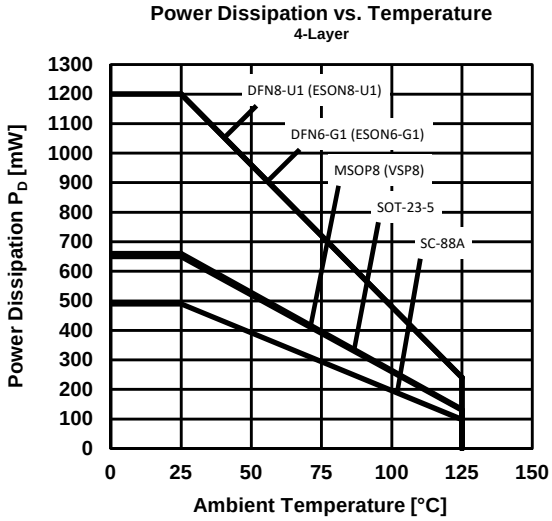
PACKAGE	SYMBOL	VALUE	UNIT
Junction-to-Ambient Thermal Resistance		2-Layer / 4-Layer (6)	
SOT-23-5	θ_{ja}	260 / 192	°C/W
SC-88A		347 / 255	
DFN6-G1 (ESON6-G1)		379 / 104 (7)	
MSOP8 (VSP8)		250 / 189	
DFN8-U1 (ESON8-U1)		278 / 104 (7)	
Junction-to-Top of Package Characterization Parameter		2-Layer / 4-Layer (6)	
SOT-23-5	ψ_{jt}	67 / 58	°C/W
SC-88A		91 / 73	
DFN6-G1 (ESON6-G1)		64 / 26 (7)	
MSOP8 (VSP8)		62 / 53	
DFN8-U1 (ESON8-U1)		42 / 25 (7)	

(6) 2-Layer: Mounted on glass epoxy board (76.2 mm × 114.3 mm × 1.6 mm: based on EIA/JEDEC standard, 2-layer FR-4).
4-Layer: Mounted on glass epoxy board (76.2 mm × 114.3 mm × 1.6 mm: based on EIA/JEDEC standard, 4-layer FR-4), internal Cu area: 74.2 mm × 74.2 mm.

(7) 2-Layer: Mounted on glass epoxy board (101.5 mm × 114.5 mm × 1.6 mm: based on EIA/JEDEC standard, 2-layer FR-4) with exposed pad.
4-Layer: Mounted on glass epoxy board (101.5 mm × 114.5 mm × 1.6 mm: based on EIA/JEDEC standard, 4-layer FR-4) with exposed pad.
(For 4-layer: Applying 99.5 mm × 99.5 mm inner Cu area and a thermal via hole to a board based on JEDEC standard JESD51-5.)

■ POWER DISSIPATION vs. AMBIENT TEMPERATURE

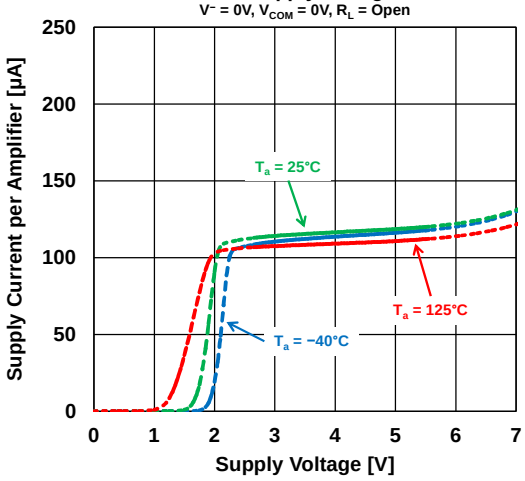




■ TYPICAL CHARACTERISTICS

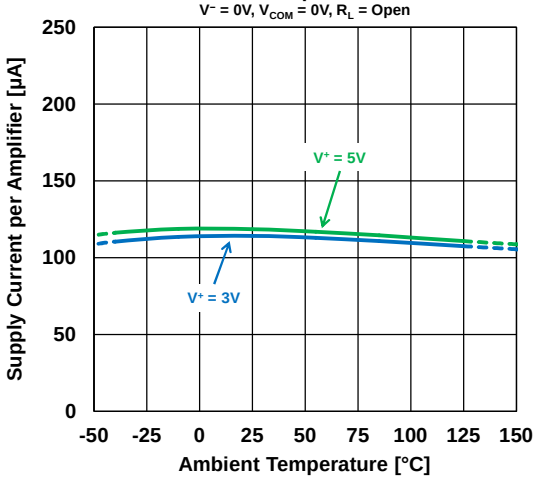
Supply Current per Amplifier vs. Supply Voltage

V^- = 0V, V_{COM} = 0V, R_L = Open



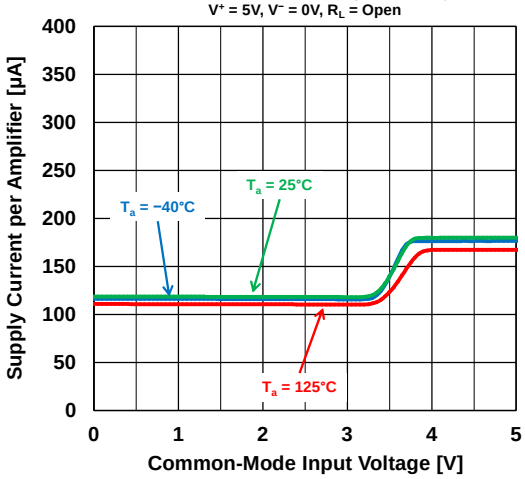
Supply Current per Amplifier vs. Temperature

V^- = 0V, V_{COM} = 0V, R_L = Open



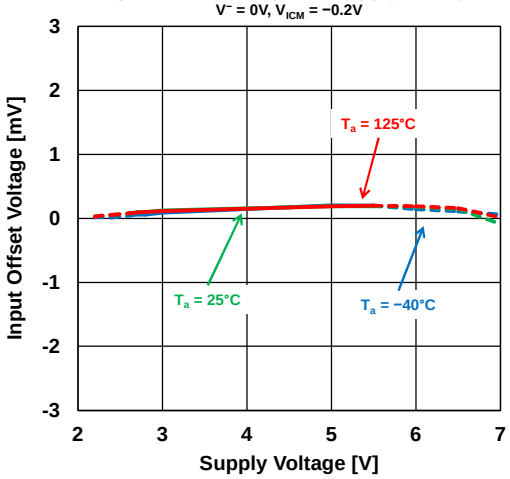
Supply Current per Amplifier vs. Common-Mode Input Voltage

V^+ = 5V, V^- = 0V, R_L = Open



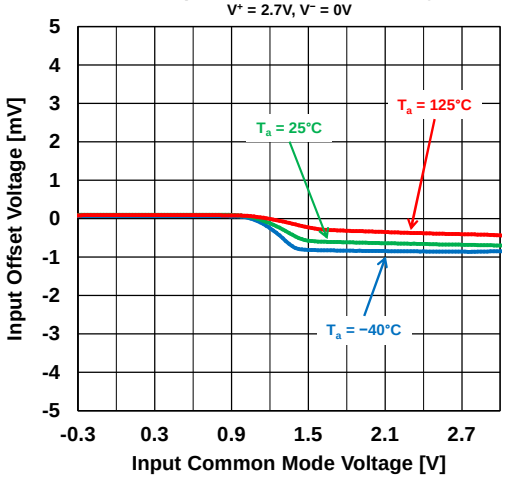
Input Offset Voltage vs. Supply Voltage

V^- = 0V, V_{ICM} = −0.2V



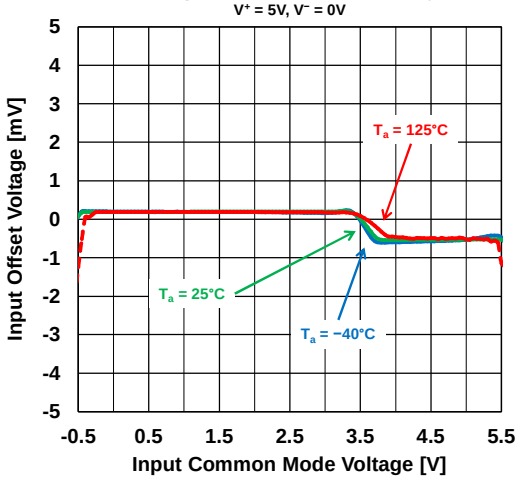
Input Offset Voltage vs. Input Common Mode Voltage

V^+ = 2.7V, V^- = 0V



Input Offset Voltage vs. Input Common Mode Voltage

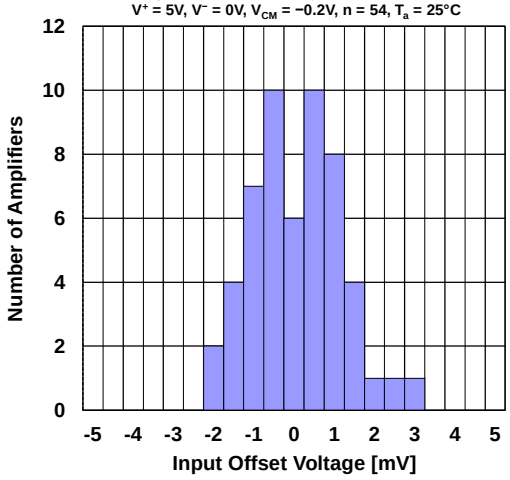
V^+ = 5V, V^- = 0V



■ TYPICAL CHARACTERISTICS

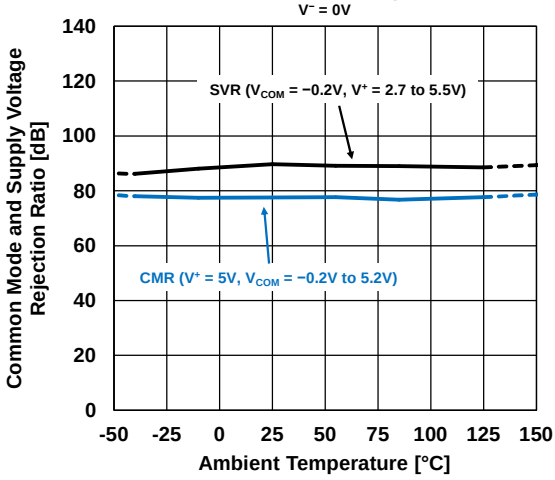
Input Offset Voltage Distribution

V^+ = 5V, V^- = 0V, V_{CM} = −0.2V, n = 54, T_a = 25°C



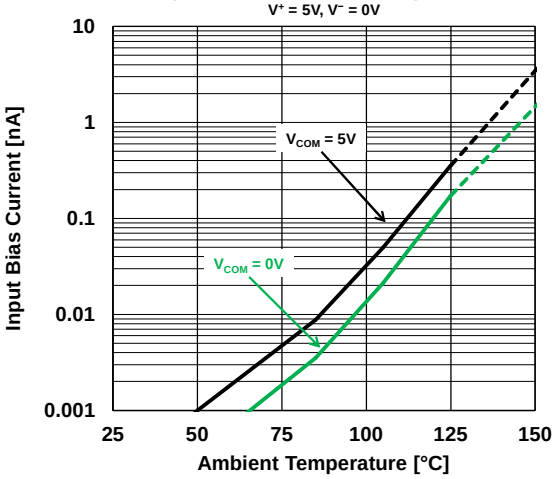
CMR and SVR vs. Temperature

V^- = 0V



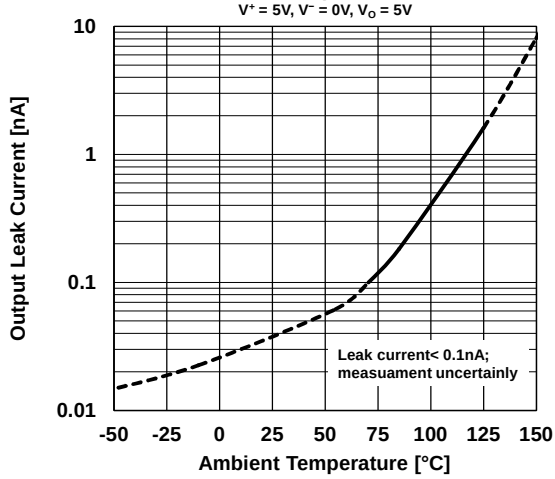
Input Bias Current vs. Temperature

V^+ = 5V, V^- = 0V



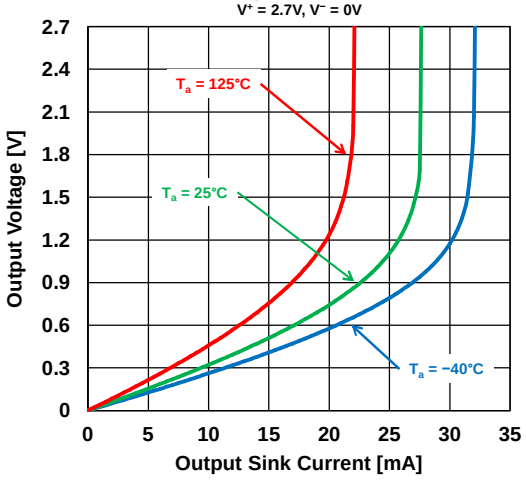
NJU7726x Output Leak Current vs. Temperature

V^+ = 5V, V^- = 0V, V_O = 5V



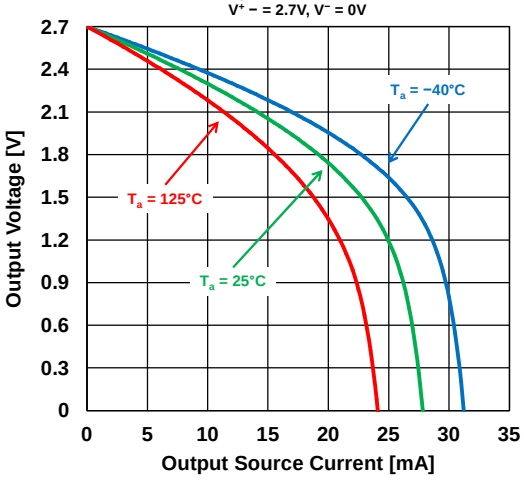
Low-level Output Voltage vs. Output Sink Current

V^+ = 2.7V, V^- = 0V



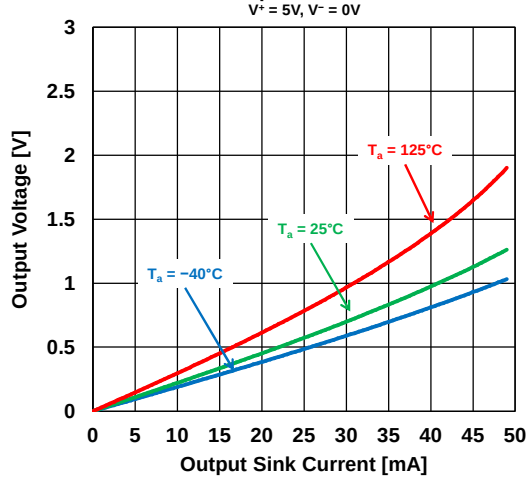
NJU7725x High-level Output Voltage vs. Output Source Current

V^+ − = 2.7V, V^- = 0V

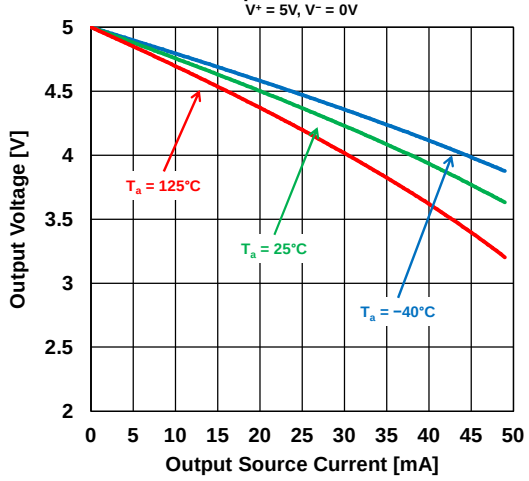


■ TYPICAL CHARACTERISTICS

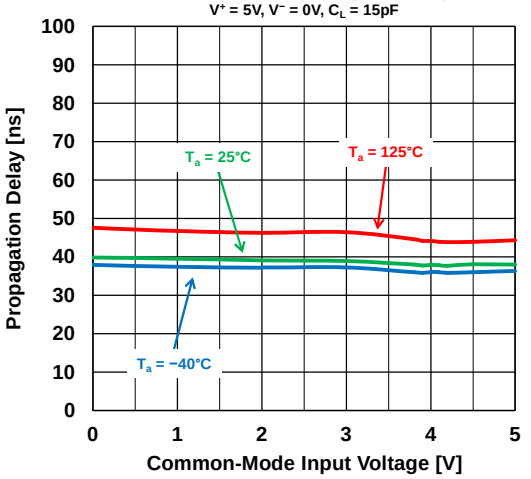
Low-level Output Voltage vs. Output Sink Current
V^+ = 5V, V^- = 0V



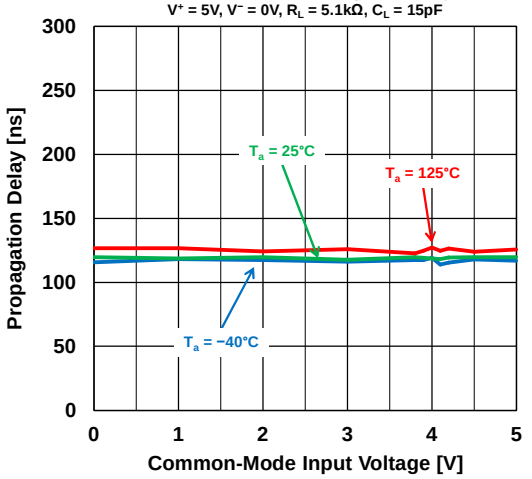
NJU7725x High-level Output Voltage vs. Output Source Current
V^+ = 5V, V^- = 0V



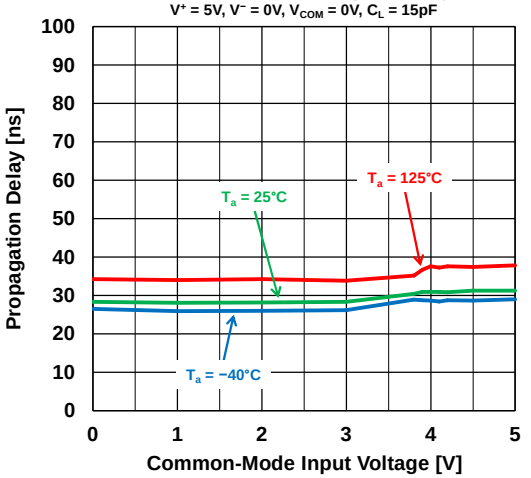
NJU7725x Propagation Delay (Low to High) vs. Common-Mode Input Voltage
V^+ = 5V, V^- = 0V, C_L = 15pF



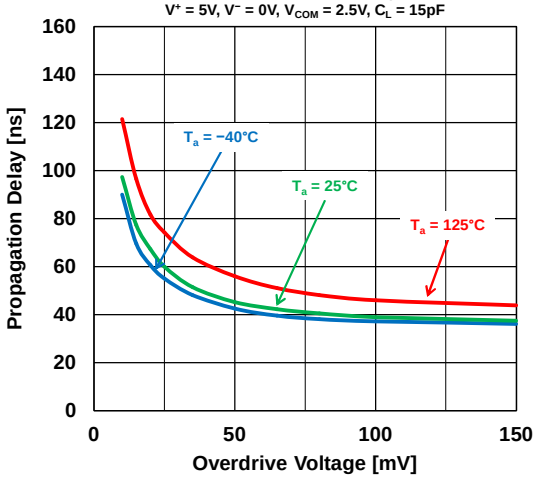
NJU7726x Propagation Delay (Low to High) vs. Common-Mode Input Voltage
V^+ = 5V, V^- = 0V, R_L = 5.1kΩ, C_L = 15pF



Propagation Delay (High to Low) vs. Common-Mode Input Voltage
V^+ = 5V, V^- = 0V, V_{COM} = 0V, C_L = 15pF



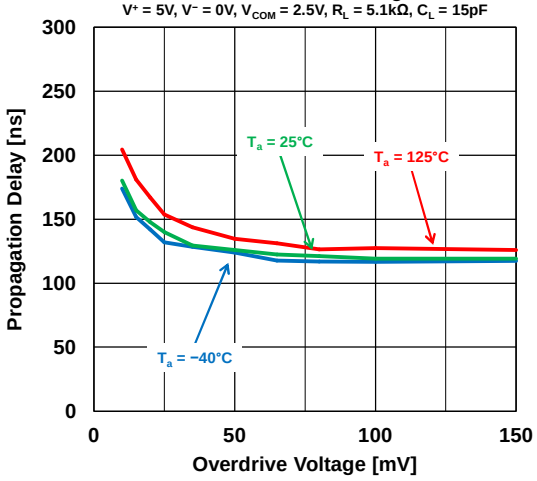
NJU7725x Propagation Delay (Low to High) vs. Overdrive Voltage
V^+ = 5V, V^- = 0V, V_{COM} = 2.5V, C_L = 15pF



■ TYPICAL CHARACTERISTICS

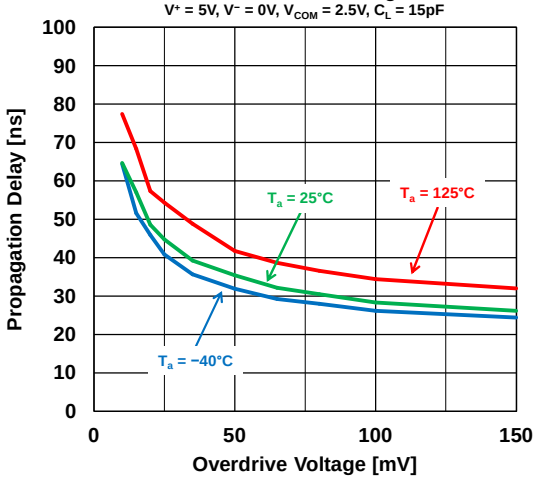
NJU7726x Propagation Delay (Low to High) vs. Overedrive Voltage

V^+ = 5V, V^- = 0V, V_{COM} = 2.5V, R_L = 5.1kΩ, C_L = 15pF



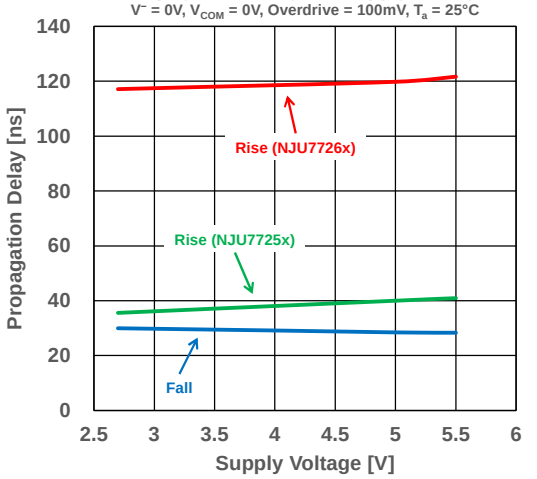
Propagation Delay (High to Low) vs. Overdrive Voltage

V^+ = 5V, V^- = 0V, V_{COM} = 2.5V, C_L = 15pF



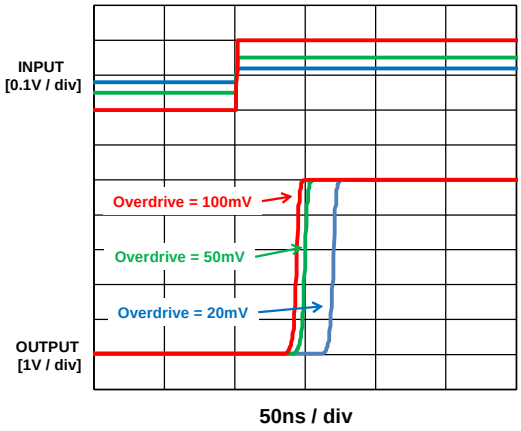
Propagation Delay vs. Supply Voltage

V^- = 0V, V_{COM} = 0V, Overdrive = 100mV, T_a = 25°C



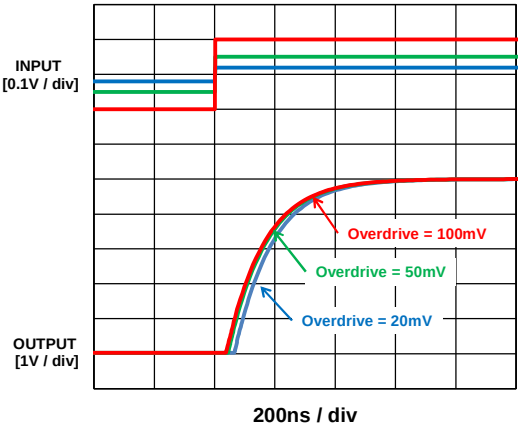
NJU7725x Transient Response (Low to High)

V^+ = 5V, V^- = 0V, V_{COM} = 0V, T_a = 25°C



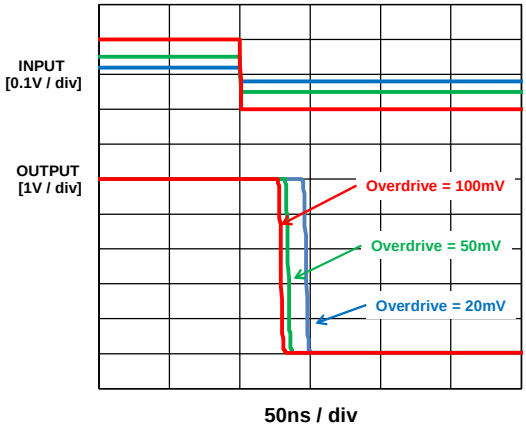
NJU7726x Transient Response (Low to High)

V^+ = 5V, V^- = 0V, V_{COM} = 0V, R_L = 5.1kΩ, T_a = 25°C



Transient Response (High to Low)

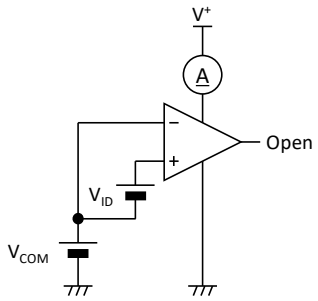
V^+ = 5V, V^- = 0V, V_{COM} = 0V, T_a = 25°C



■ TEST CIRCUITS

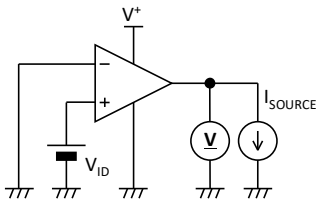
● I_{SUPPLY}

V_{ID} = 100mV



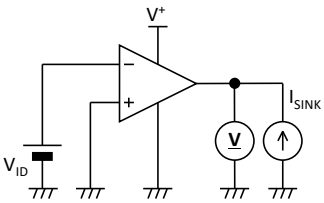
● V_{OH}

V_{ID} = 100mV



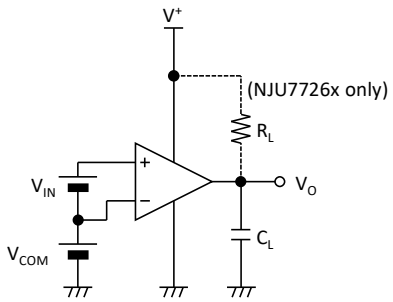
● V_{OL}

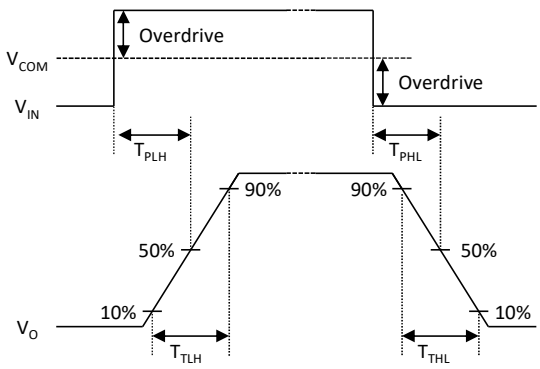
V_{ID} = 100mV



● Propagation Delay

R_L = 5.1kΩ, V_{COM} = 0V, V^+, C_L = 15pF





■ APPLICATION NOTE

Single and Dual Supply Voltage Operation

The NJU7725x, NJU7726x series works with both single supply and dual supply when the voltage supplied is between V^+ and V^-. These comparators operate from single 2.7V to 5.5V supply and dual ±1.35V to ±2.75V supply. The power supply pin should have bypass capacitor (i.e. 0.1µF).

Input Voltage

The NJU7725x, NJU7726x series are Rail-to-Rail input comparators. The common mode input voltage range is V^- − 0.2V to V^+ + 0.2V, and the differential input voltage can be any voltage within supply voltage. No phase inversion of the comparator output occurs when the input range of V^- − 0.2V to V^+ + 0.2V.

Inputs of the NJU7725x, NJU7726x series are protected by ESD diodes (shown in Figure 1) that will conduct if the input voltages exceed the power supplies by more than approximately 300mV. Momentary voltages greater than 300mV beyond the power supply, inputs can be tolerated if the current is limited to 10mA.

Figure 2 is simple accomplished with an input resistor. If the input voltage exceeds the supply voltage, the input current must be limited 10mA or less by using a restriction R_{LIMIT} as shown in figure 2.

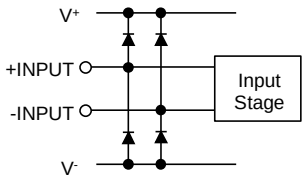


Figure 1. Simplified Schematic

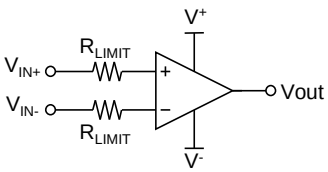


Figure 2. Input Current Protection for Voltages exceeding the Supply Voltage.

Output Voltage

The NJU7725x series features a push-pull output. The output logic level is the same as the supply rail. The circuit can be simplified without the need for an external pull-up resistor.

The NJU7726x series has an open drain output. It can be pulled up to an external power supply up to V^- + 5.5V independent of supply voltage. It can be applied to window comparators and logic level converter.

Dynamic Transient Stabilizer ™

The NJU7725x and NJU7726x series use the new circuit technology Dynamic Transient Stabilizer ™ to realize a rail-to-rail input that suppresses fluctuations in propagation delay.

A general rail-to-rail input comparator operates within the supply rails, but when the input signal level is close to the supply voltage, the propagation delay will decrease and may not be as designed.

Figure 3 compares the NJU7725x and NJU7726x with a conventional rail-to-rail input comparators. Conventional comparators have a delay of 20 ns close to the supply voltage. This change in propagation delay requires a review of the design margin, which increases the design period.

By using the NJU7725x and NJU7726x series with Dynamic Transient Stabilizer ™, stable response can be obtained in any voltage within supply voltage.

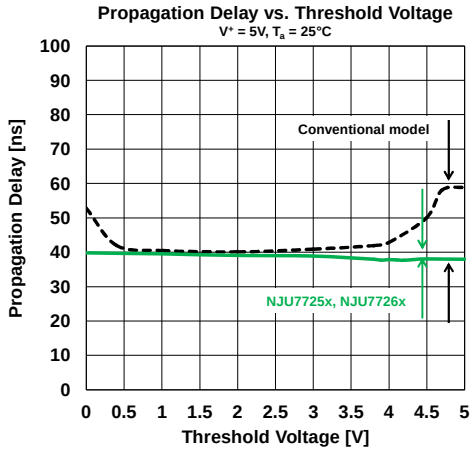
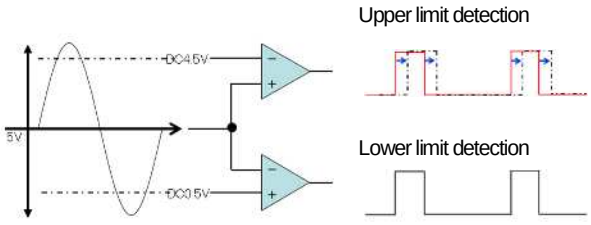


Figure 3. Propagation delay vs. Threshold Voltage

Figure 4 shows a window comparator circuit using the NJU7726x series. Even if the threshold setting is set near the power supply voltage, stable operation can be performed without delay in response time.



In conventional comparators, the upper limit detection was changed.
-> Lower limit detection and upper limit detection are different.

Figure 4. Level detection circuit using window comparator

■ APPLICATION NOTE

Terminating unused comparators

Examples of common methods of terminating an uncommitted comparator are shown in Figure 5. Improper termination can be result increase supply current, heating and noise in comparators.

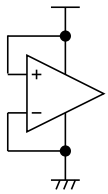


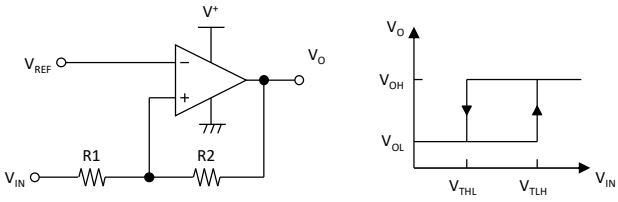
Figure 5. Terminating unused comparators

External Hysteresis

The comparator can change the threshold by using positive feedback. The difference in threshold voltage is called hysteresis, which can improve noise immunity and operation for low-speed signals.

Noninverting Comparator with Hysteresis

Figure 6 shows a hysteresis comparator circuit with two resistors. Assuming that the threshold at which the comparator output is Low-High is V_{TLH} and the threshold at which the comparator output is High-Low is V_{THL}, to achieve the following hysteresis are below.



$$V_{TLH} = \frac{R1+R2}{R2} V_{REF} - \frac{R1}{R2} V_{OL}$$

$$V_{THL} = \frac{R1+R2}{R2} V_{REF} - \frac{R1}{R2} V_{OH}$$

Figure 6. Noninverting Comparator with Hysteresis

Inverting Comparator with Hysteresis

Igure7 shows a hysteresis comparator circuit with three resistors.

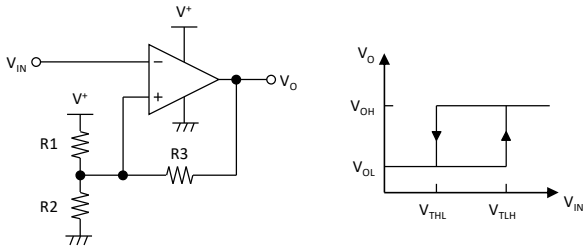
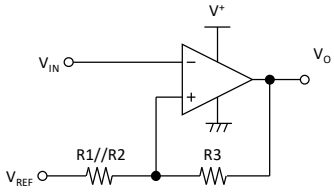


Figure 7. Inverting Comparator with Hysteresis

If R1 and R2 of the circuit in Figure 7 are represented by equivalent resistors, the circuit will be as shown in Figure 8. Since this circuit is the same as the noninverting hysteresis comparator, V_{TLH} and V_{THL} can be calculated by rearranging the equations.



$$R1 /\!/ R2 = \frac{R1R2}{R1+R2}$$

$$V_{REF} = \frac{R2}{R1+R2} V^{+}$$

$$V_{TLH} = \frac{R1 /\!/ R2}{R1 /\!/ R2+R3} V_{REF} + \frac{R1 /\!/ R2}{R1 /\!/ R2+R3} V_{OL}$$

$$V_{THL} = \frac{R1 /\!/ R2}{R1 /\!/ R2+R3} V_{REF} + \frac{R1 /\!/ R2}{R1 /\!/ R2+R3} V_{OH}$$

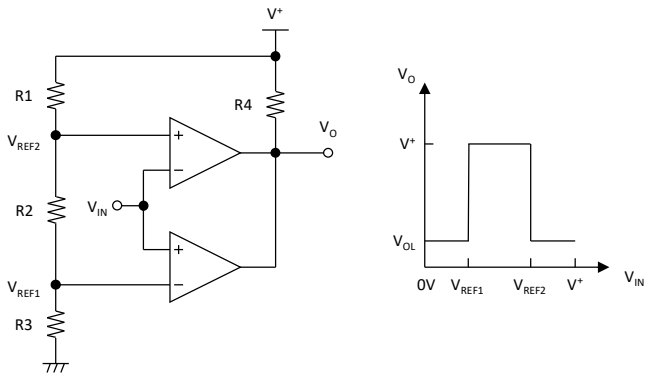
Figure 8. Noninverting hysteresis comparator as equivalent circuits

■ APPLICATION NOTE

Window Comparator

By using the open drain type NJU7726x in parallel, it is achieve to detect whether the signal is between two reference voltages. This circuit is commonly called a window comparator and can be used for monitoring the reference voltage and monitoring abnormal voltages such as signal voltage drop or overvoltage.

Figure 9 shows a simple window comparator circuit.
The comparator output V_O is High only when V_{IN} is between V_{REF1} and V_{REF2}, and Low otherwise. If chattering occurs during the output shift period, connect capacitors in parallel with R1 and R3.



$$V_{REF1} = \frac{R3}{R1+R2+R3} V^+$$

$$V_{REF2} = \frac{R2+R3}{R1+R2+R3} V^+$$

Figure 9. Window Comparator with NJU7726x

Example)
Assuming V^+ = 3.3V, R1 = R2 = R3 = 1MΩ, R4 = 10kΩ, the thresholds from the formula in Figure 9 are V_{REF1} = 1.1V, V_{REF2} = 2.2V.
V_O is Low when V_{IN} < 1.1V or V_{IN} > 2.2V, and V_O is High when V_{IN} is between1.1V and 2.2V (Figure 10).

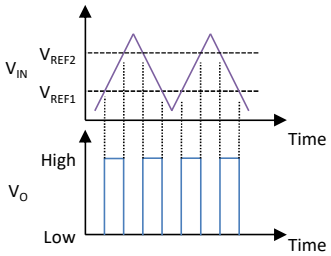


Figure 10. Window comparator output results

Square Wave Oscillator

Figure 11 shows a simple square wave oscillator circuit. It can be used to digital circuits such as microcomputers, oscillation circuits, timing waveforms, and driver circuits for electronic buzzers.

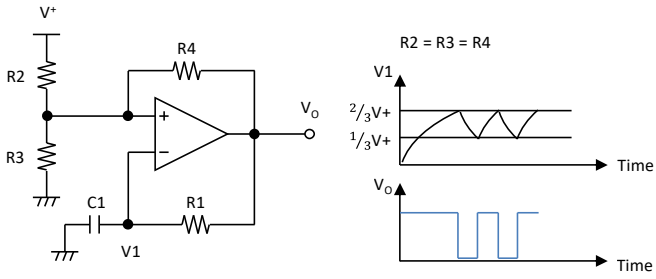


Figure 11. Square Wave Oscillator

When R2 = R3, the oscillator circuit has 50% duty, and the oscillation frequency is as follows.

$$f = \frac{1}{2R1C1 \ln\left(1+\frac{R4}{R3}\right)} \text{ [Hz]}$$

$$R2 = R3$$

R4 sets the threshold of the comparator that switches between charging and discharging to C1. If R2 = R3 = R4, the oscillation frequency is as follows.

$$f = \frac{1}{2R1C1 \ln 2} \text{ [Hz]}$$

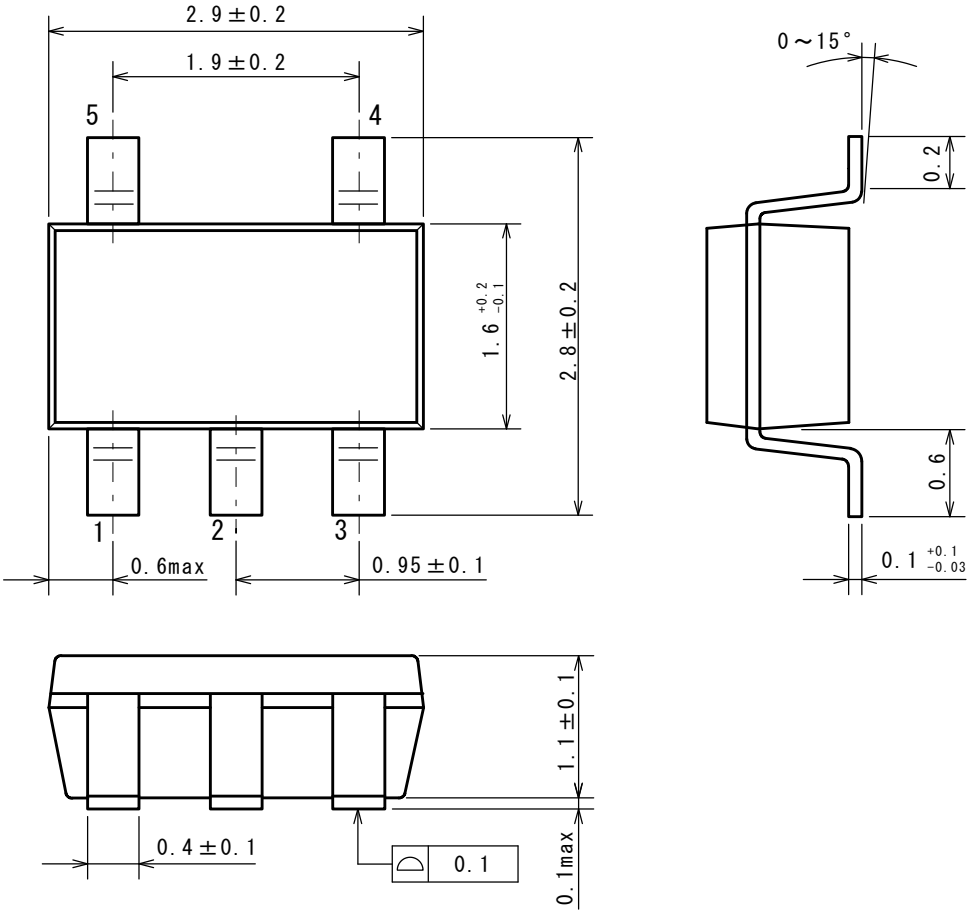
$$R2 = R3 = R4$$

SOT-23-5

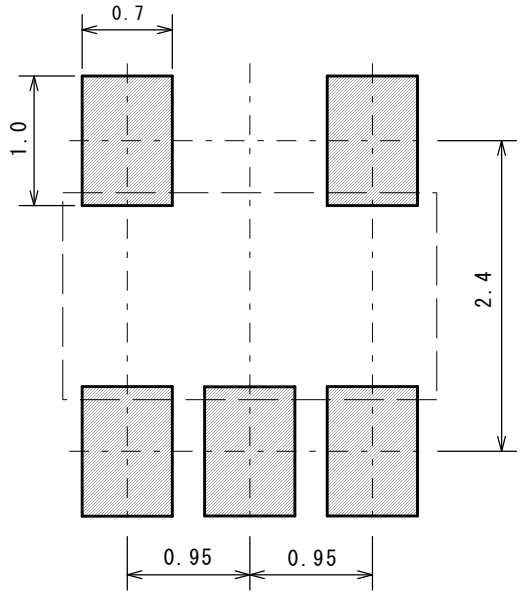
PRELIMINARY SPECIFICATIONS SUBJECT TO CHANGE

Unit: mm

■ PACKAGE DIMENSIONS



■ EXAMPLE OF SOLDER PADS DIMENSIONS

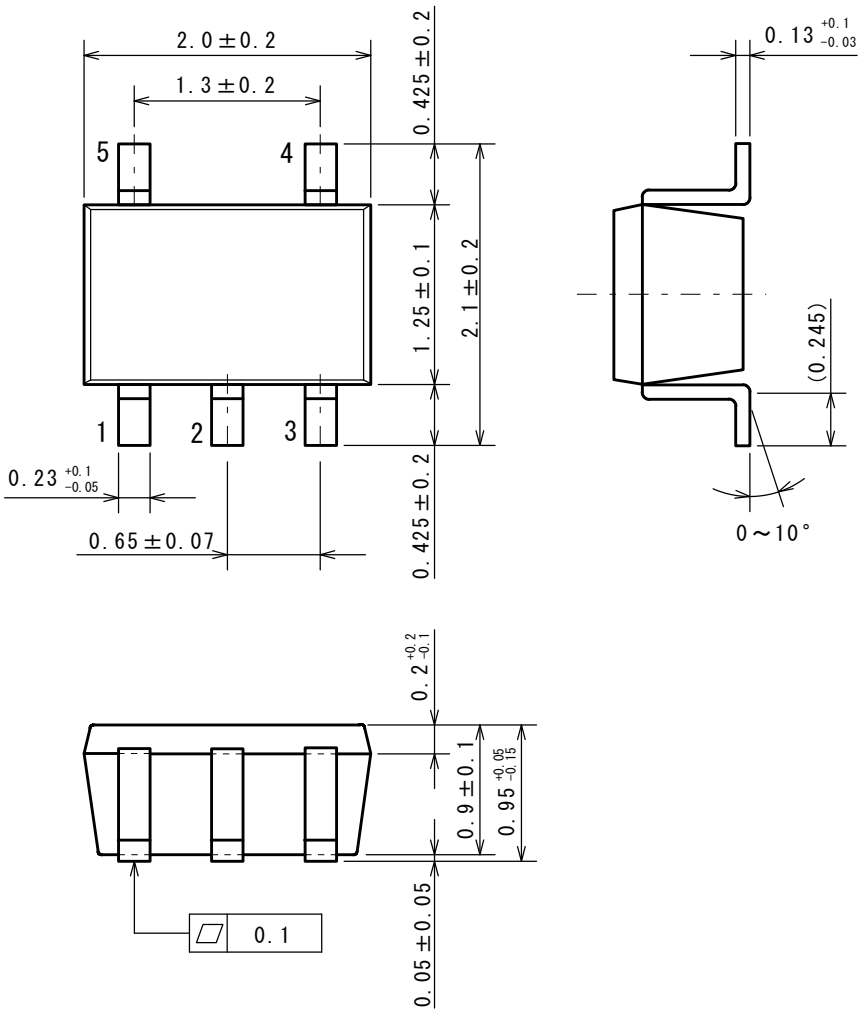


SC-88A

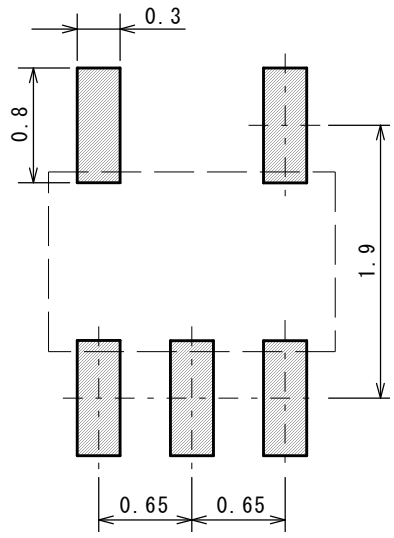
PRELIMINARY SPECIFICATIONS SUBJECT TO CHANGE

Unit: mm

■ PACKAGE DIMENSIONS



■ EXAMPLE OF SOLDER PADS DIMENSIONS

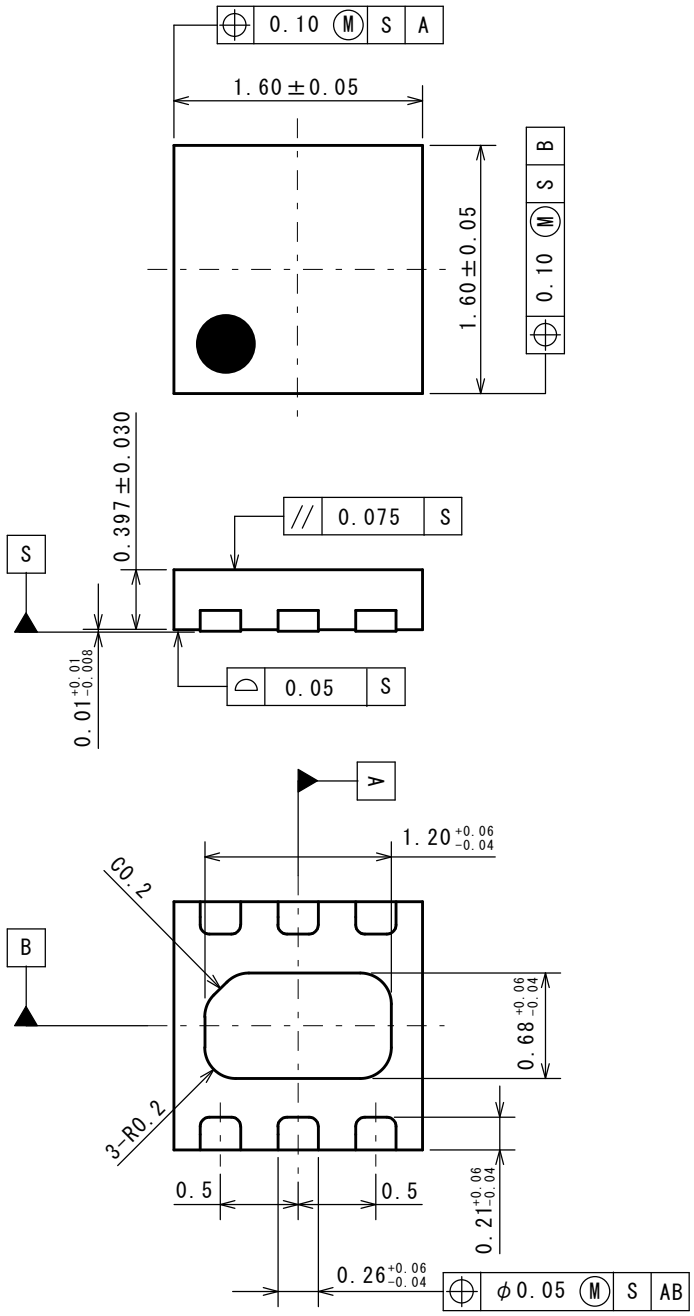


DFN6-G1

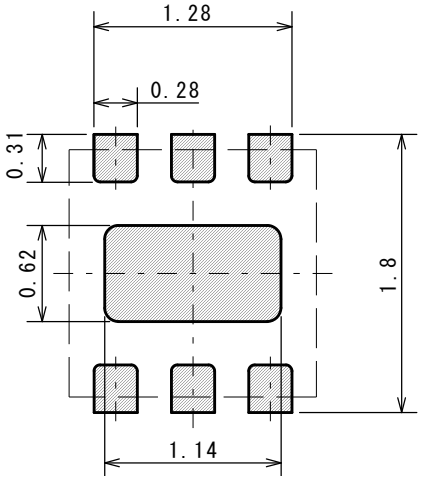
PRELIMINARY SPECIFICATIONS SUBJECT TO CHANGE

Unit: mm

■ PACKAGE DIMENSIONS



■ EXAMPLE OF SOLDER PADS DIMENSIONS

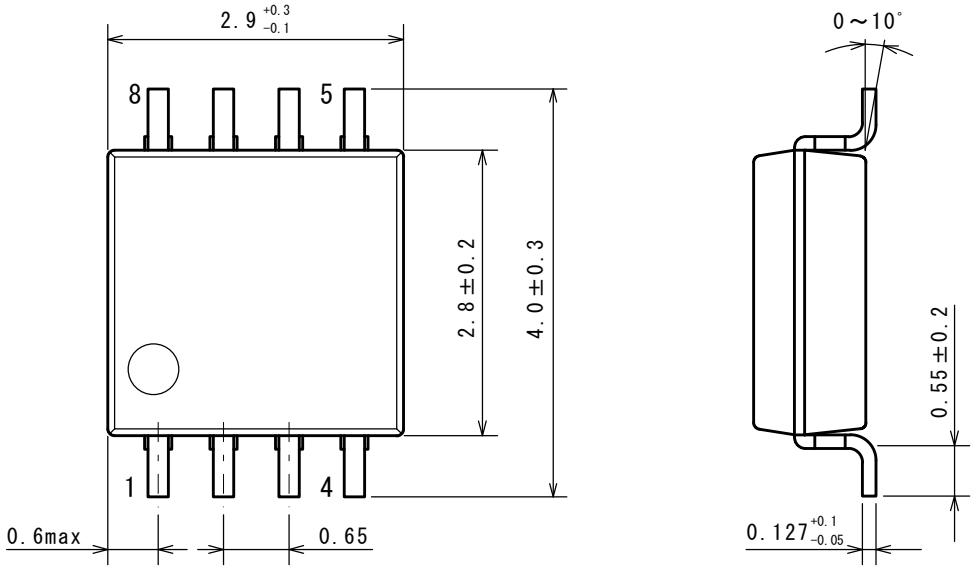


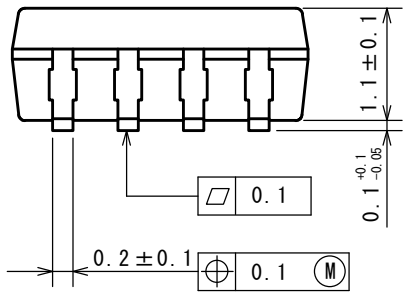
PRELIMINARY SPECIFICATIONS SUBJECT TO CHANGE

MSOP8 (VSP8) JEDEC MO-187-DA

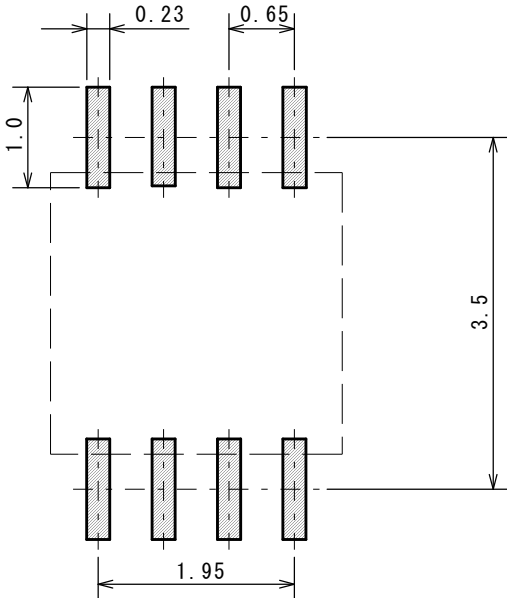
Unit: mm

■ PACKAGE DIMENSIONS





■ EXAMPLE OF SOLDER PADS DIMENSIONS

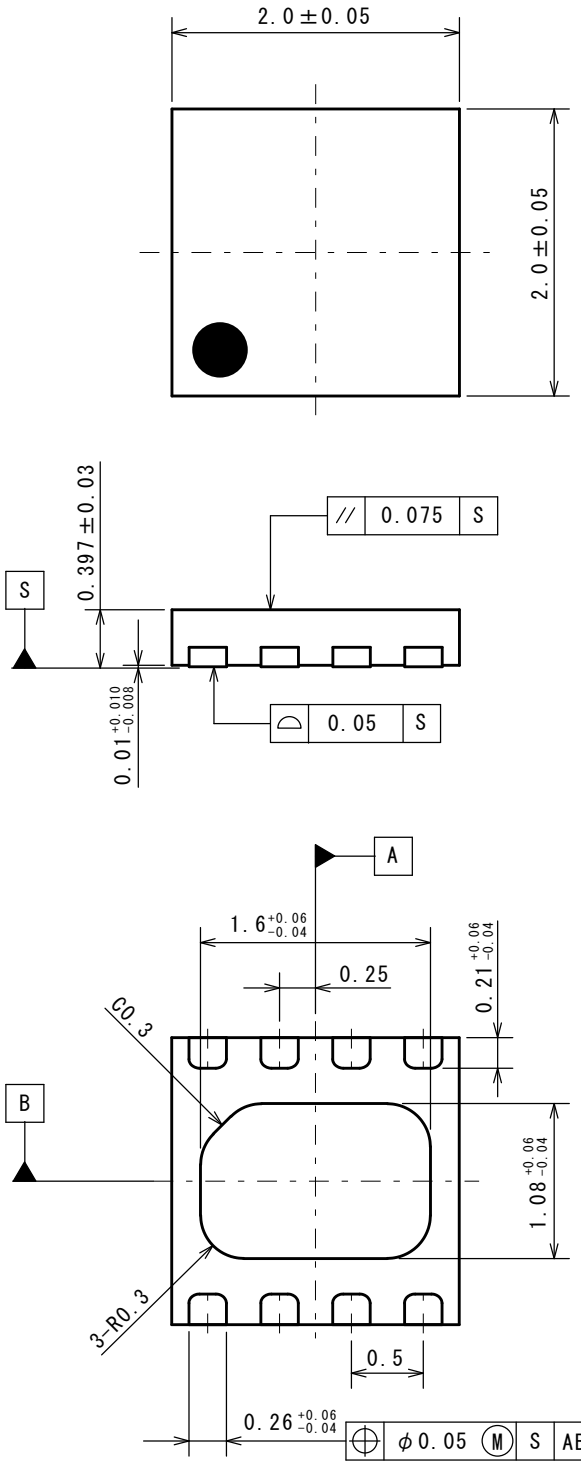


DFN8-U1

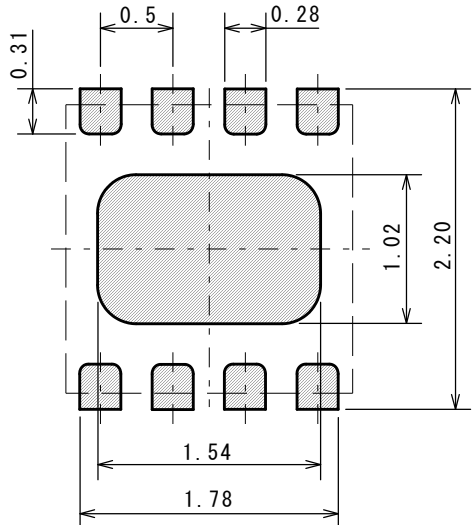
PRELIMINARY SPECIFICATIONS SUBJECT TO CHANGE

Unit: mm

■ PACKAGE DIMENSIONS



■ EXAMPLE OF SOLDER PADS DIMENSIONS



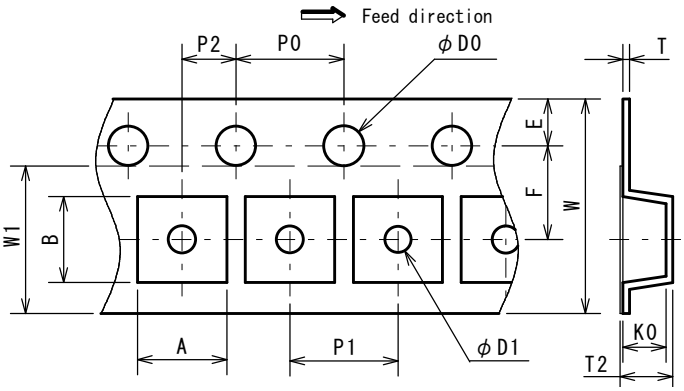
PRELIMINARY SPECIFICATIONS SUBJECT TO CHANGE

SOT-23-5

■ PACKING SPEC

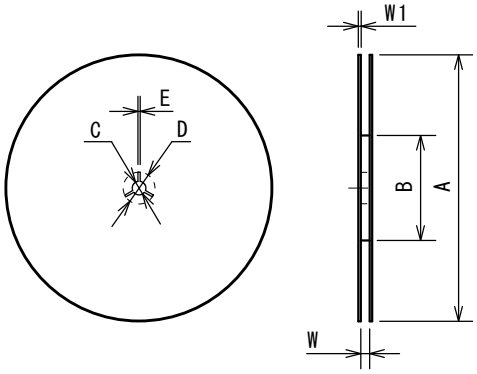
Unit: mm

TAPING DIMENSIONS



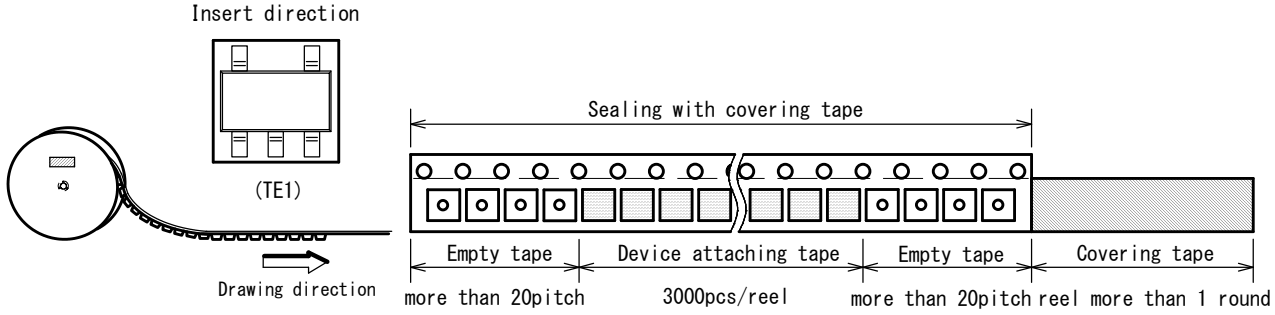
SYMBOL	DIMENSION	REMARKS
A	3.3±0.1	BOTTOM DIMENSION
B	3.2±0.1	BOTTOM DIMENSION
D0	1.55	
D1	1.05	
E	1.75±0.1	
F	3.5±0.05	
P0	4.0±0.1	
P1	4.0±0.1	
P2	2.0±0.05	
T	0.25±0.05	
T2	1.82	
K0	1.5±0.1	
W	8.0±0.3	
W1	5.5	THICKNESS 0.1MAX

REEL DIMENSIONS

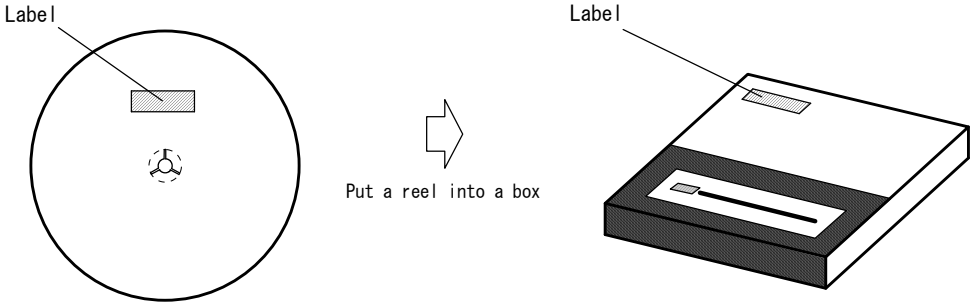


SYMBOL	DIMENSION
A	φ180±1
B	φ 60±1
C	φ 13±0.2
D	φ 21±0.8
E	2±0.5
W	9±0.5
W1	1.2±0.2

TAPING STATE



PACKING STATE



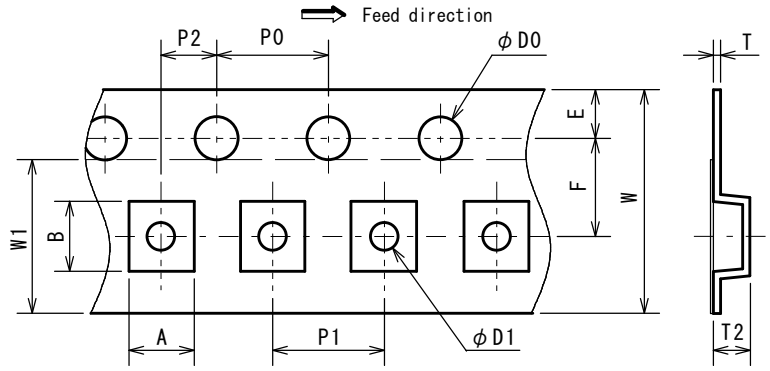
PRELIMINARY SPECIFICATIONS SUBJECT TO CHANGE

SC-88A

■ PACKING SPEC

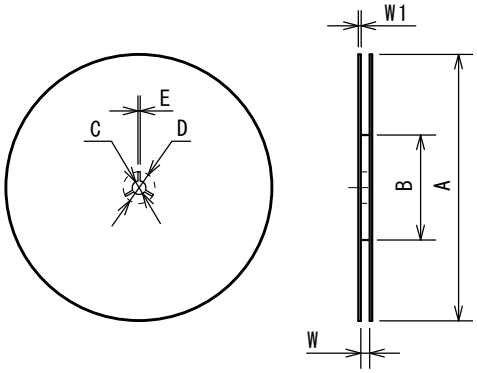
Unit: mm

TAPING DIMENSIONS



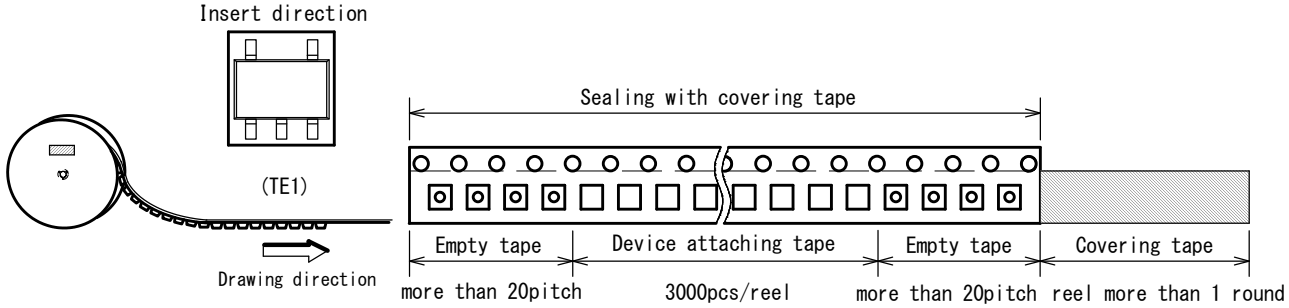
SYMBOL	DIMENSION	REMARKS
A	2.3±0.1	BOTTOM DIMENSION
B	2.5±0.1	BOTTOM DIMENSION
D0	1.55±0.05	
D1	1.05±0.05	
E	1.75±0.1	
F	3.5±0.05	
P0	4.0±0.1	
P1	4.0±0.1	
P2	2.0±0.05	
T	0.25±0.05	
T2	1.3±0.1	
W	8.0±0.2	
W1	5.5	THICKNESS 0.1max

REEL DIMENSIONS

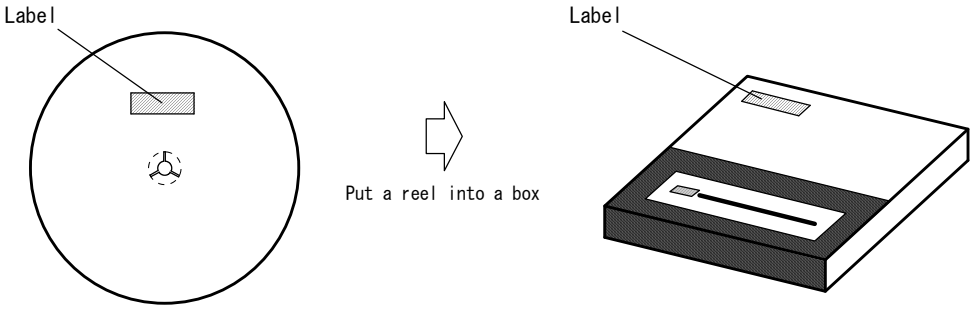


SYMBOL	DIMENSION
A	φ180±1
B	φ 60±1
C	φ 13±0.2
D	φ 21±0.8
E	2±0.5
W	9±0.5
W1	1.2±0.2

TAPING STATE



PACKING STATE



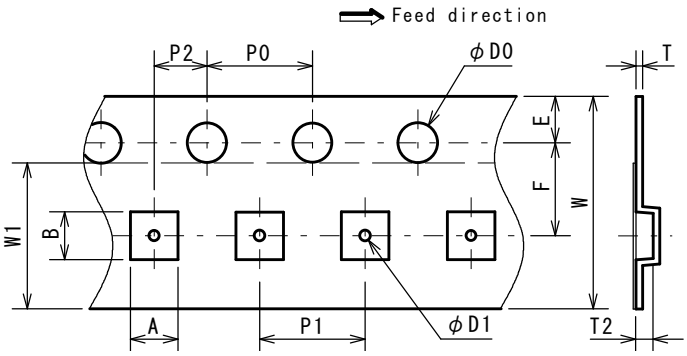
PRELIMINARY SPECIFICATIONS SUBJECT TO CHANGE

DFN6-G1

■ PACKING SPEC

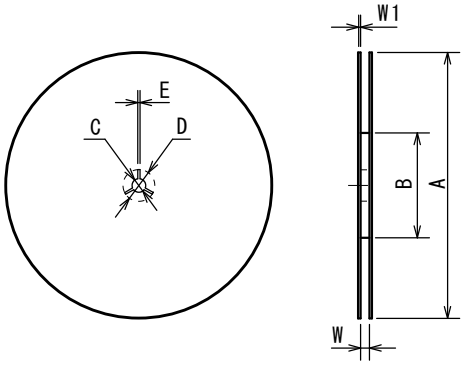
Unit: mm

TAPING DIMENSIONS



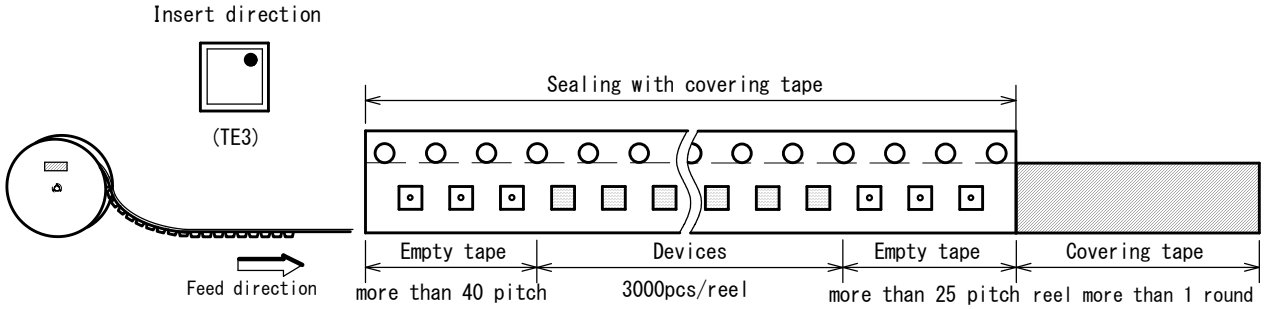
SYMBOL	DIMENSION	REMARKS
A	1.85±0.05	BOTTOM DIMENSION
B	1.85±0.05	BOTTOM DIMENSION
D0	$1.5^{+0.1}_{0}$	
D1	0.5±0.1	
E	1.75±0.1	
F	3.5±0.05	
P0	4.0±0.1	
P1	4.0±0.1	
P2	2.0±0.05	
T	0.25±0.05	
T2	0.65±0.05	
W	8.0±0.2	
W1	5.5	THICKNESS 0.1max

REEL DIMENSIONS

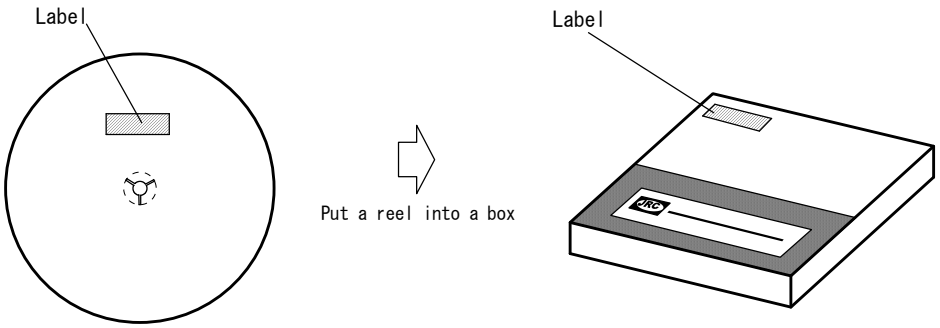


SYMBOL	DIMENSION
A	$\phi 180^{0}_{-1.5}$
B	$\phi 60^{+1}_{0}$
C	φ 13±0.2
D	φ 21±0.8
E	2±0.5
W	$9^{+0.3}_{0}$
W1	1.2

TAPING STATE



PACKING STATE



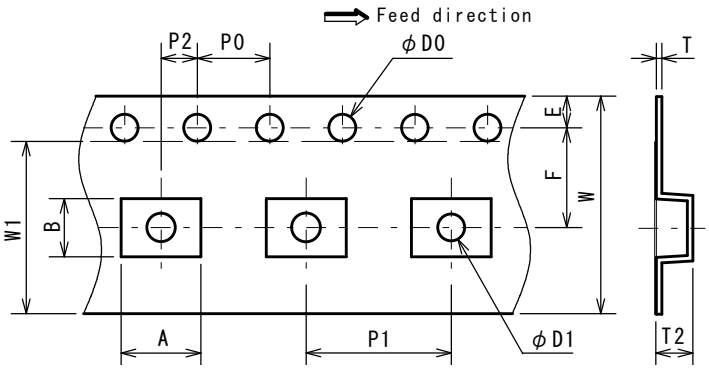
PRELIMINARY SPECIFICATIONS SUBJECT TO CHANGE

MSOP8 (VSP8) MEET JEDEC MO-187-DA

Unit: mm

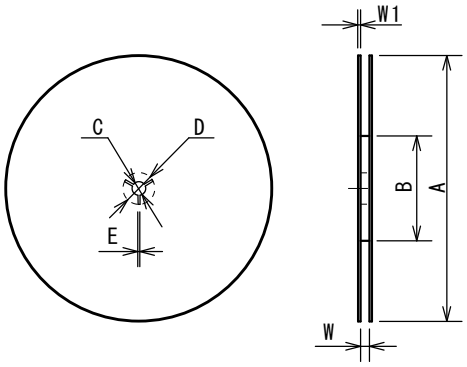
■ PACKING SPEC

TAPING DIMENSIONS



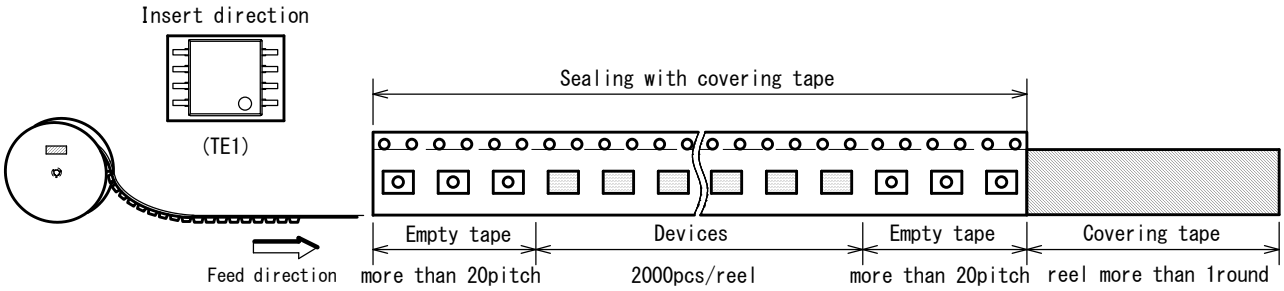
SYMBOL	DIMENSION	REMARKS
A	4.4	BOTTOM DIMENSION
B	3.2	BOTTOM DIMENSION
D0	$1.5^{+0.1}_{0}$	
D1	$1.5^{+0.1}_{0}$	
E	1.75±0.1	
F	5.5±0.05	
P0	4.0±0.1	
P1	8.0±0.1	
P2	2.0±0.05	
T	0.30±0.05	
T2	2.0 (MAX.)	
W	12.0±0.3	
W1	9.5	THICKNESS 0.1max

REEL DIMENSIONS

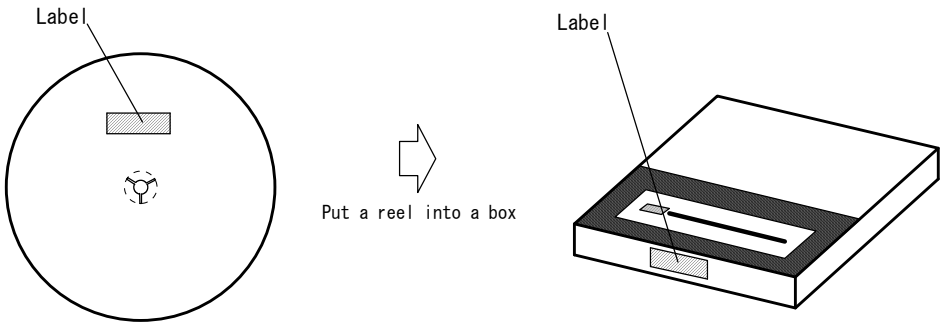


SYMBOL	DIMENSION
A	φ254±2
B	φ100±1
C	φ 13±0.2
D	φ 21±0.8
E	2±0.5
W	13.5±0.5
W1	2.0±0.2

TAPING STATE



PACKING STATE



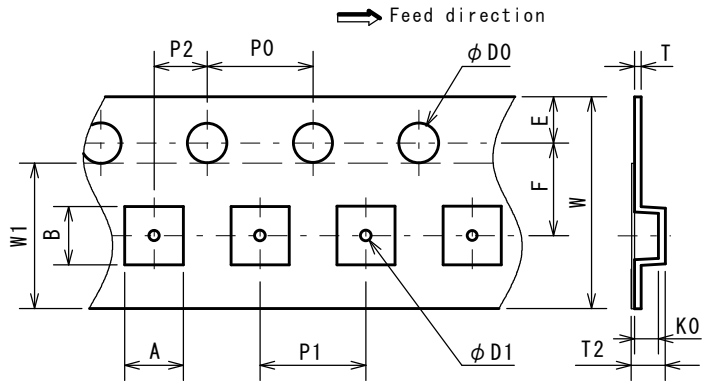
PRELIMINARY SPECIFICATIONS SUBJECT TO CHANGE

DFN8-U1

■ PACKING SPEC

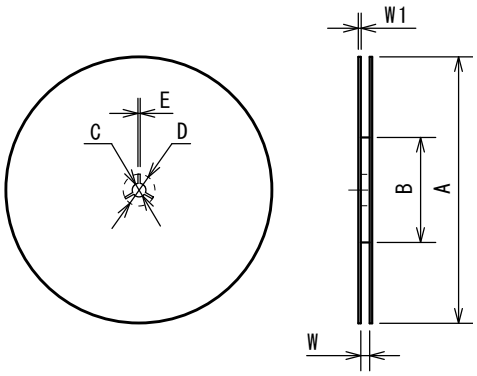
Unit: mm

TAPING DIMENSIONS



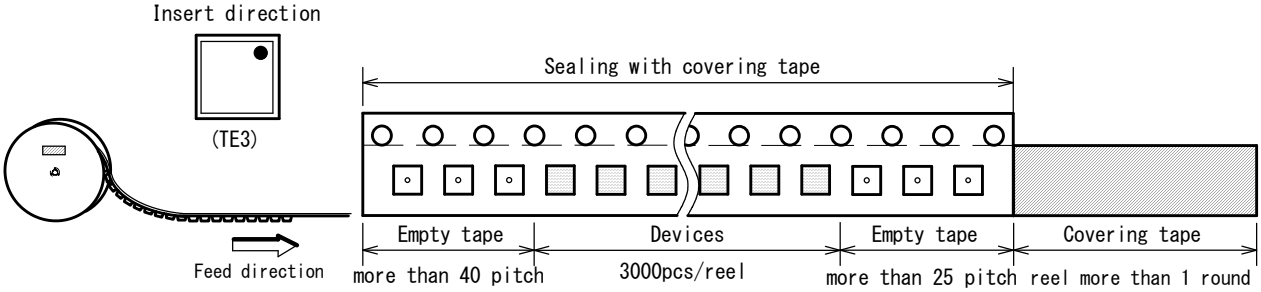
SYMBOL	DIMENSION	REMARKS
A	2.25±0.05	BOTTOM DIMENSION
B	2.25±0.05	BOTTOM DIMENSION
D0	$1.5^{+0.1}_{0}$	
D1	0.5±0.1	
E	1.75±0.1	
F	3.5±0.05	
P0	4.0±0.1	
P1	4.0±0.1	
P2	2.0±0.05	
T	0.25±0.05	
T2	1.00±0.07	
K0	0.65±0.05	
W	8.0±0.2	
W1	5.5	THICKNESS 0.1max

REEL DIMENSIONS

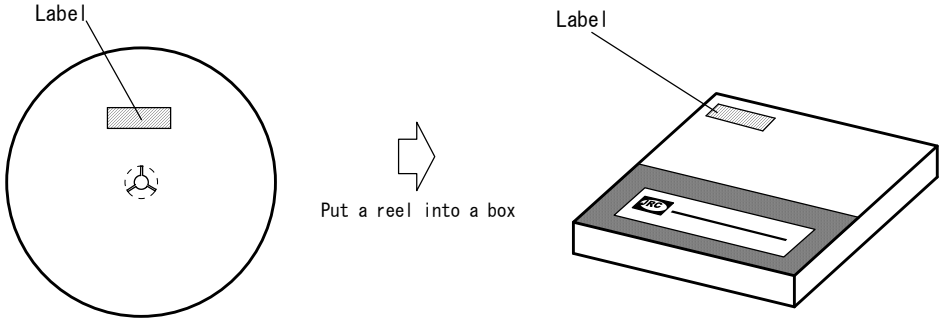


SYMBOL	DIMENSION
A	$\phi 180^{0}_{-1.5}$
B	$\phi 60^{+1}_{0}$
C	φ 13±0.2
D	φ 21±0.8
E	2±0.5
W	$9^{+0.3}_{0}$
W1	1.2

TAPING STATE

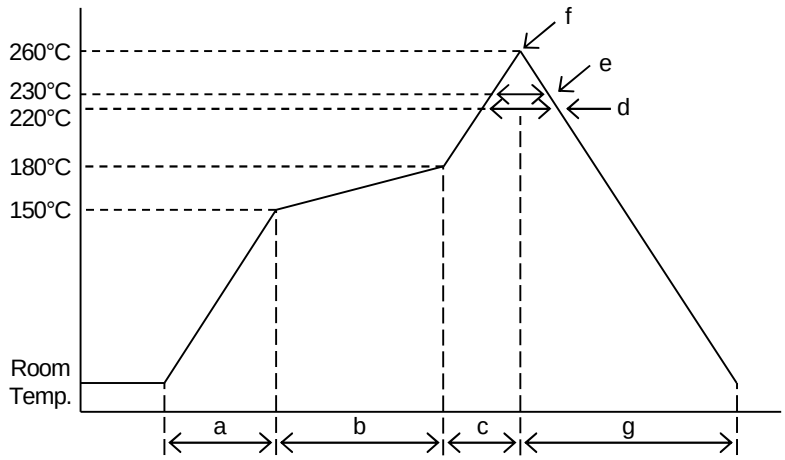


PACKING STATE



■ RECOMMENDED MOUNTING METHOD

INFRARED REFLOW SOLDERING PROFILE



a	Temperature ramping rate	1 to 4°C/s
b	Pre-heating temperature Pre-heating time	150 to 180°C 60 to 120s
c	Temperature ramp rate	1 to 4°C/s
d	220°C or higher time	shorter than 60s
e	230°C or higher time	shorter than 40s
f	Peak temperature	lower than 260°C
g	Temperature ramping rate	1 to 6°C/s

The temperature indicates at the surface of mold package.

■ REVISION HISTORY

DATE	REVISION	CHANGES
August 31, 2020	Ver.0.0	Initial Release
August 19, 2021	Ver.0.1	Added NJU7726x series Added Application Note.
September 22, 2021	Ver.0.2	Updated Descriptions.

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   - Equipment Used in the Deep Sea
   - Power Generator Control Equipment (Nuclear, steam, hydraulic, etc.)
   - Life Maintenance Medical Equipment
   - Fire Alarms / Intruder Detectors
   - Vehicle Control Equipment (Automobile, airplane, railroad, ship, etc.)
   - Various Safety Devices

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